Center Innovation Fund: AFRC CIF

Fused Reality for Enhanced Training and Flight Research

Completed Technology Project (2013 - 2014)

Project Introduction

An updated, advanced head-mounted display is providing test pilots with unprecedented analysis and evaluation capabilities for aircraft and pilot performance, tasks that until now have been largely evaluated subjectively. The Fused Reality system combines real-world images from a video camera with computer-generated virtual images to create a highly immersive environment for complex tasks, such as landing, formation flying, and aerial refueling. Originally developed under a NASA Small Business Innovation Research (SBIR) contract and flight-tested on a Calspan Learjet, this tool has been significantly improved, new tasks and capabilities have been added, and is now a portable, standalone system that can be easily integrated on a wide range of flight test aircraft.

Work to date: This project enabled Armstrong researchers to add functionality to the system first developed under an SBIR contract. The Fused Reality tool provides pilots with a high-fidelity in-flight simulator that can be used for training or repeatable handling quality evaluations. A standalone navigation system now provides aircraft state data, eliminating the need to obtain this data from aircraft instrumentation and allowing the system to be installed on virtually any aircraft. In-flight uses have been expanded from aerial refueling to include training tasks for formation flight, runway approach, and landing.

The Fused Reality system has been integrated into the National Test Pilot School's Gippsland GA-8 Airvan research aircraft to support flight test and evaluation of the system. Eight functional flights were flown on the NTPS GA-8 Airvan. These flights identified several improvements and system fixes which were corrected prior to the next flight test. In Januaray 2015, 4 evaluation flight of FR were flown by NASA test pilots. The system worked perfectly and the pilots were able to provide handling qualities ratings and comments for the test aircraft. No delays or other system issues were reported by the pilots. It was felt that pilot ratings were represenative of the aircraft performance and were not influenced by the Fused Reality System.

Looking ahead: Researchers are discussing applications with a diverse set of potential users. The Fused Reality system will be further evlauted in a test program with the USAF Test Pilot School in March 2016. In this test program, the aircrft performance will be rated using tradiitional real world tasks such as offset landing and formation flight. These two tasks will then be evaluted using similar virtual tasks generated by Fused Reality. It is predicted that the rating will match using both methods further confirming the ability of FR to generate handlign qualites tasks that reflect true aircraft performance.

Partners: Systems Technology, Inc. and National Test Pilots School

Benefits:

Fused Reality System in use by pilot

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- **Portable**: The system can be quickly installed on any aircraft.
- **Versatile**: Supported tasks include training, pilot/task evaluation, and post-flight analysis of aircraft and pilot performance.
- **Powerful**: Pilot workload measures can be computed both in real time and post-flight and then compared and subjectively scored.

Applications:

- Test pilot training
- Astronaut training with robotic devices for exploration missions
- Enhancement of unmanned aircraft system ground stations for improved operator situational awareness
- In-flight aircraft carrier landing training
- Commercial space astronaut training

Anticipated Benefits

This technology has potential to benefit funded NASA missions in two distinct ways. For in-flight evaluation for new aircraft cofigurations and advanced flight controls, Fused Reality generates realistic, immersive and repeatable handling qualites tasks that are safer and more affordable than traditional handlinq qualites tasks which require additional aircraft. These handling qualties tasks are used by test pilots to evalaute and rate new aircraft configurations and advanced flight control laws.

Fused Reality can also be used for astronaut and pilot training at NASA. Currently flying tasks like formation flight, aerial refuelling and landing can be taught safely using Fused Reality. In addition, potential astronaut traning taks are also being ideintified. Fused Reality is also being investigated for remote opertaion of UAVs and planetary exploration rovers.

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Armstrong Flight Research Center (AFRC)

Responsible Program:

Center Innovation Fund: AFRC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

David F Voracek

Principal Investigator:

Bruce R Cogan

Co-Investigator:

Edward Bachelder

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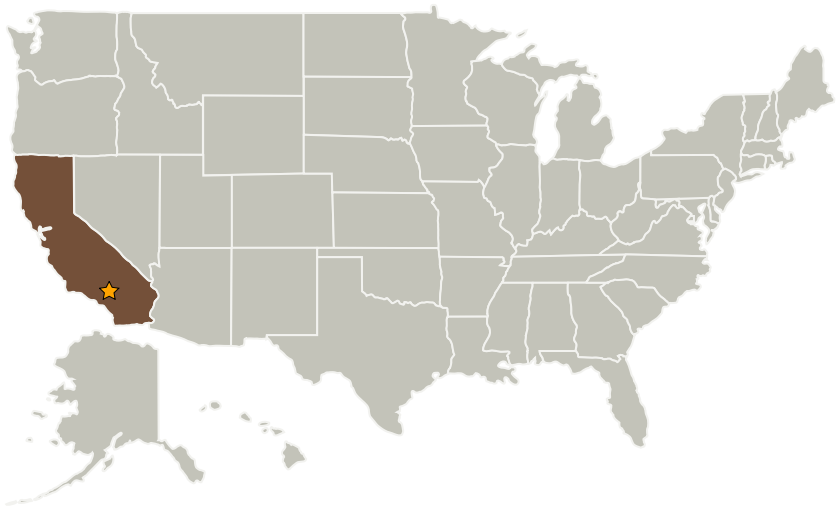
Primary U.S. Work Locations and Key Partners

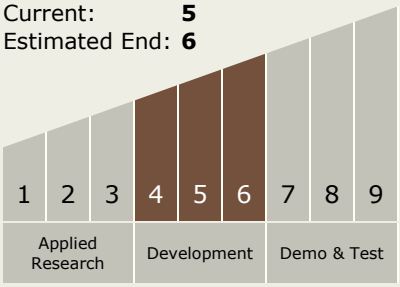


Organizations Performing Work	Role	Type	Location
★Armstrong Flight Research Center(AFRC)	Lead Organization	NASA Center	Edwards, California
National Test Pilot School	Supporting Organization	Academia	Mojave, California
Systems Technology, Inc	Supporting Organization	Industry	

Primary U.S. Work Locations
California

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **6**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.2 Flight Mechanics
    - TX15.2.3 Flight Mechanics Testing and Flight Operations

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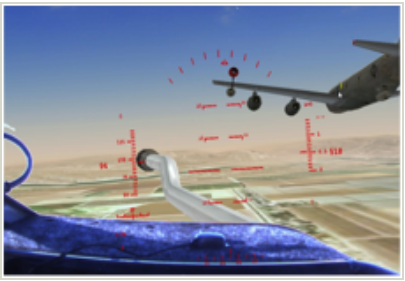
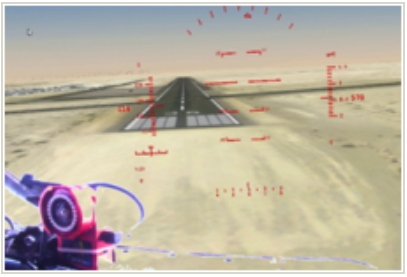
Images



Fused Reality Aerial Refuelling Task
Fused Reality Aerial Refuelling Task *(https://techport.nasa.gov/image/6608)*

Fused Reality Gippsland GA-8 Airvan test aircraft
Fused Reality Gippsland GA-8 Airvan Test Aircraft *(https://techport.nasa.gov/image/6611)*



Fused Reality Runway landing task
Fused Reality Runway landing task *(https://techport.nasa.gov/image/6610)*

Fused Reality System in use by pilot
Fused Reality System in use by pilot *(https://techport.nasa.gov/image/6609)*

Stories

Untitled
(https://techport.nasa.gov/file/21809)